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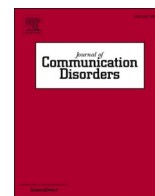
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# Communication skills predict social-emotional competencies

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## ABSTRACT

**Introduction:** Studies have shown that many children with early language difficulties also have delays in social-emotional competencies as well as social-emotional and behavioral problems. It is unclear if these conditions are causally related, if they share a common underlying etiology, or if there are bidirectional effects. Studies investigating these associations have mostly involved children who are already using words to communicate, but it is important to know whether delays in preverbal communication and language development have any effects on these associations. The aim of the present study was to examine associations between preverbal communication and early verbal skills in infancy and subsequent social-emotional competencies and ensuing social-emotional and behavioral problems in early toddlerhood. The role of background factors known to influence early language development was also examined.

**Methods:** The sample consisted of 395 children (51.6% boys) from the Finnish Steps Study cohort. Language was assessed at age 13 months ( $\pm$  1 month) with the MacArthur Communicative Development Inventory for Infants (CDI-I), and the social-emotional domain was assessed at age  $\leq$  17 months with the Brief Infant-Toddler Social and Emotional Assessment (BITSEA).

**Results:** Infants with lower preverbal gestural communication and receptive language skills had a higher risk of delays in social-emotional competencies in toddlerhood than children with better communication skills, but not of elevated social-emotional and behavioral problems.

**Conclusions:** The results indicate that lower early communication skills can predict delays in the development of social-emotional competencies, which has been found to be a risk factor for later development of social-emotional and behavioral problems. It is important to monitor early communication skills to provide guidance to parents in supporting early pragmatic communication and language development in infancy, if needed.

## 1. Introduction

An important milestone in children's social-emotional development is the first social smile, which emerges at about 2–3 months of

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age, and leads to increased social interaction (Heberle et al., 2020). This coincides with the emergence of pragmatic communication, which occurs in reciprocal interaction with caregivers, appears first in turn-taking ability, and leads gradually to acquiring language Airenti (2017). Thus, from the earliest months of life, social-emotional and language development are inter-twined.

Associations between developmental language difficulties and delays in social-emotional competencies as well as social-emotional and behavioral problems have been reported in many studies (e.g., meta-analysis by Yew & O'Kearney, 2013), but it is not clear whether language and communication difficulties are a consequence of social-emotional and behavioral problems, or vice versa, or if their effects are bidirectional. One possibility is that early emerging language and communication difficulties have a negative influence on social interaction, which can lead to emotional and self-regulation problems (St Clair et al., 2019). The association between language and social-emotional problems has mostly been studied in children who have already reached the verbal stage in their language development, with expressive vocabulary being the measure of language ability (Henrichs et al., 2013; Horwitz et al., 2003; Irwin et al., 2002; Sim et al., 2013; Whitehouse et al., 2011). What is new in the present study is that preverbal and early verbal skills in infants are used to examine the associations between communication skills and possible delays in social-emotional competencies and possible social-emotional and behavioral problems subsequently in early toddlerhood.

### 1.1. Pragmatics and early language acquisition

According to both the usage-based theory Tomasello (2009) and the social-pragmatic view (Bruner, 1983, pp. 23–42), children acquire language through social interaction. The preverbal period, described as pure pragmatics, is essential for language acquisition (Stephens & Matthews, 2014). Stephens and Matthews, (2014) define pragmatics as the 'ability to use speech and gestures appropriately, taking the demands of the physical context and the needs of the interlocutor into account' (p. 14). Essential elements of pragmatics are the structure of conversation, and certain rules for the dialogue Airenti (2017). The most important of these rules is turn-taking, which is the first pragmatic feature infants learn when adults interpret their voicing and movements as communicative acts. Eye contact and especially starting to follow the gaze of an adult proceeds to the development of joint attention skills at about 9 months of age (Tomasello & Carpenter, 2007). Development continues towards shared intentionality and social-cognitive skills at 10–11 months (Brooks & Meltzoff, 2005). Children begin to initiate joint attention episodes themselves through gazing and pointing Tomasello (2009), which enables sharing attention to something in the environment with someone else and knowing that both are aware of the same target (Tomasello & Carpenter, 2007).

Joint attention with gaze following and pointing belongs to preverbal communication and is closely associated with language acquisition (Brooks & Meltzoff, 2005; Colonnese et al., 2010; Orr, 2018). Deictic pointing is especially related to language development (Colonnese et al., 2010). Gradually, the child begins to use culturally based conventional gestures like head nodding and iconic gestures that are now independent of context. These gestures are used like words (Goldin-Meadow, 2009). This shows how even preverbal children can produce their own communicative acts and understand the intentions of others in their acts Airenti (2017). An exception are children with autism spectrum disorders (ASD) who have been found to have impaired use of gestures (Ramos-Cabo et al., 2019). However, this impairment among children with autism spectrum disorders is not clearly noticeable until after 12 months of age.

When interacting with others in joint attention situations, children hear words and observe gestures about the objects around them, and gradually learn to understand words Clark (2014). Usually this mapping of words to objects begins between 7 and 10 months of age (Fenson et al., 1994; Harris et al., 1995; Stolt et al., 2008).

Twelve months of age is the milestone at which children are expected to produce their first words, although there is wide individual variation (Fenson et al., 1994; Harris et al., 1995; Kunnari, 2000; Stolt et al., 2008). Carpenter et al. (1983) have reported that children at 15 months of age still expressed most of their communicative intentions with combined gestures and vocalizations, and only seldom used words in isolation. Caselli et al. (2012) found that children began using more words than gestures after 17 months of age.

According to the literature, there are some confounding factors that affect children's early communication and language development. In a meta-analysis conducted by Rudolph (2017), clinically significant risk factors associated with child language disorders were low maternal education level, very low 5 min Apgar scores, later birth order, and male gender. There are also additional factors, including 1) Genetics: language disorders commonly aggregate in families (Bishop & Hayiou-Thomas, 2008; Flax et al., 2003; Tallal et al., 2001; Zambrana et al., 2014); 2) Premature birth: many premature children have slower language development than full-term children (Barre et al., 2011; van Noort-van der Spek et al., 2012; Vohr, 2014); and 3) SES: there is evidence that low socio-economic status in the family is a risk for delayed language development (Fernald et al., 2013; see overview by Roy & Chiat, 2013). In addition, maternal age has been found to correlate with child language development, but the results are inconsistent. The results of some studies favor older mothers over teenage mothers (Keown et al., 2001; Sutcliffe et al., 2012), but others show the opposite (McNally & Quigley, 2014).

### 1.2. Social-emotional competencies and possible social-emotional and behavioral problems

Social-emotional competencies can be defined as effectiveness in social interaction with other people (Rose-Krasnor & Denham, 2009, pp. 163–172). Further, this effectiveness can be defined by how well a person succeeds in reaching intra- and interpersonal goals. Different skills and motivations help to reach these goals. Briggs-Gowan and Carter (2006) describe these skills in young children as including attention, compliance, mastery motivation, prosocial peer relations, empathy, imitation/play skills, and social relatedness. Because social-emotional competencies manifest in an individual when he or she interacts with other people communication skills are needed (Rose-Krasnor & Denham, 2009, p. 164). Social-emotional competencies appear in different ways depending on the child's developmental phase (Rose-Krasnor & Denham, 2009, pp. 163–172). A child can attain social-emotional competencies even without

spoken language.

There are different theories about how emotions develop but most recognize that emotions develop in social interaction with the caregiver (Heberle et al., 2020). An early social and emotional milestone is the first social smile at about 2–3 months of age, when the child begins to enjoy social interaction. After 6 months infants begin to respond to different emotions expressed with voice or facial expressions; with joy for joyful expressions, and by turning away or becoming distressed when seeing or hearing angry or sad expressions (Heberle et al., 2020). After the first birthday, children begin to be interested in other children and babies and pretend play begins to occur. There is variation in children's emotional reactions and expressions that are associated with children's temperament Rothbart (1981). However, more reactive or more withdrawal styles are not always a result of a child's temperament as they may reflect social-emotional problems (Heberle et al., 2020).

Good social-emotional competencies can help the child in challenging situations when interacting with others, but weak competencies can be a risk for social-emotional and behavioral (SEB) problems. SEB problems can include internalizing, externalizing and/or dysregulation issues (Briggs-Gowan et al., 2006; Carter et al., 2003). In early childhood, internalizing problems can emerge as withdrawal/depression, shyness/inhibition, anxiety and/or fears. Externalizing problems include aggressive behavior, overactivity, impulsivity and/or peer aggression. Dysregulation problems refer to areas of negative emotionality, poor sleep and eating, and sensory sensitivities (see Briggs-Gowan & Carter, 2006).

Instead of studying these problems in older children only, recent research has also begun to focus on toddlers (Briggs-Gowan et al., 2006; Beernink et al., 2008; Carter et al., 2004; Mathiesen & Sanson, 2000; Mäntymaa et al., 2012). Occasional challenging behavior is part of a toddler's normal psychosocial development, but if such behavior is too frequent, appears too intense or is widely spread across relationships and contexts, it is considered clinically problematic (Carter et al., 2003). Beernink et al. (2008) found that problem behavior can be observed at the age of 14 months (see also Möricke et al., 2013). According to Skovgaard et al. (2008), important markers of these problems, like atypical neuro-cognitive functioning, eating and sleeping problems, and disturbances in parents' relations to the child, can be detected as early as 10 months of age, with predictive value to later neuro-developmental problems. Infants' and toddlers' social and emotional difficulties are not transient, which makes early detection, professional evaluation and parental assessment very important (Briggs-Gowan et al., 2006; Mesman & Koot, 2001; Skovgaard et al., 2008). Only after identification and detection can effective interventions be planned (Briggs-Gowan & Carter 2008; Briggs-Gowan et al., 2006; Lavigne et al., 1998).

### 1.3. Associations between language development and social-emotional competencies and problems

Associations between developmental language disorder (DLD) and SEB problems and deficits in social-emotional competencies have been repeatedly reported (e.g., meta-analysis by Yew & O'Kearney, 2013). On the other hand, good language skills in toddlerhood and better rate of language growth in preschool have been associated with better self-regulation of anger and greater use of positive strategies in frustrating situations (Bendezú et al., 2018; Roben et al., 2013). However, many of the studies concerning this subject have been conducted with preschool or schoolchildren already diagnosed with DLD. When social-emotional competencies and SEB problems have been studied in children with delayed language development (late talkers) between 18 and 36 months of age, similar results to those in older children already diagnosed with DLD have been found. These toddlers tend to have more internalizing problems than children with typical language development (Henrichs et al., 2013; Irwin et al., 2002; Keegstra et al., 2010) and also to have lower social abilities (Longobardi et al., 2016). Late talkers have more problems with general social-emotional competence, social relatedness, and atypical behavior than children with typical language development (Thurm et al., 2018). Moreover, better communication skills in toddlerhood have been associated with good social-emotional competencies (Haapsamo et al., 2012; Horwitz et al., 2003).

Although there are results showing associations between delayed language development and SEB problems in toddlers, contradicting results also exist. Whitehouse et al. (2011) found that late talking children in a cohort study showed more externalizing and internalizing difficulties at 2 years of age but not anymore in later childhood. Aarne et al. (2014), as well as Longobardi et al. (2016), found that there were differences in social-emotional development in age-matched toddlers with and without language delay but not in language-matched groups. This indicates that the association between language development and social abilities is linked through the concurrent development, and if the language development is late, it may hinder the development of the social abilities age appropriately. In addition, the results of Rescorla et al. (2007) show that the association disappears if children with neurodevelopmental delay and pervasive developmental disorders are excluded. However, toddlers with delayed language development without these other disorders still showed more social withdrawal than typically developing children (Rescorla et al., 2007).

Although previous studies show that both DLD and delayed language development have associations with SEB problems, it is unclear whether they are causally related to each other—and if so, which one drives the association—or if this association is a result of comorbidity (i.e., a shared underlying etiology). Horwitz et al. (2003) suggest that poor social competence interacts with poor expressive language development, which leads to behavior problems. Thurm et al. (2018) propose that this association can be bidirectional. On the other hand, St Clair et al. (2019) suggest that there could be a functional cause of SEB problems in children with DLD, meaning that early emerging language and communication difficulties have a negative influence on social interaction, which can lead to emotional and self-regulation problems. Thus, there is need to know whether a delay in early communication and language development affects this association. However, to our knowledge, there are no studies on the relationships of infants' preverbal communication and early language development to toddlers' social-emotional competencies and social-emotional and behavioral problems. If preverbal communication and early language development are associated with social-emotional competencies and SEB problems, this knowledge could guide parents and other caretakers to support children's communication development in infancy. Thus, research with younger children is warranted.

The present study examines associations between preverbal communication and early verbal skills in infancy and subsequent

social-emotional competencies and social-emotional and behavioral problems in early toddlerhood. In addition, we controlled for the effects of certain background factors (i.e., child sex, Apgar score, mother's age when giving birth, mother's social status, father's social status, special education of the mother, and special education of the father), often found to influence language development in children.

The research questions and the hypothesis were:

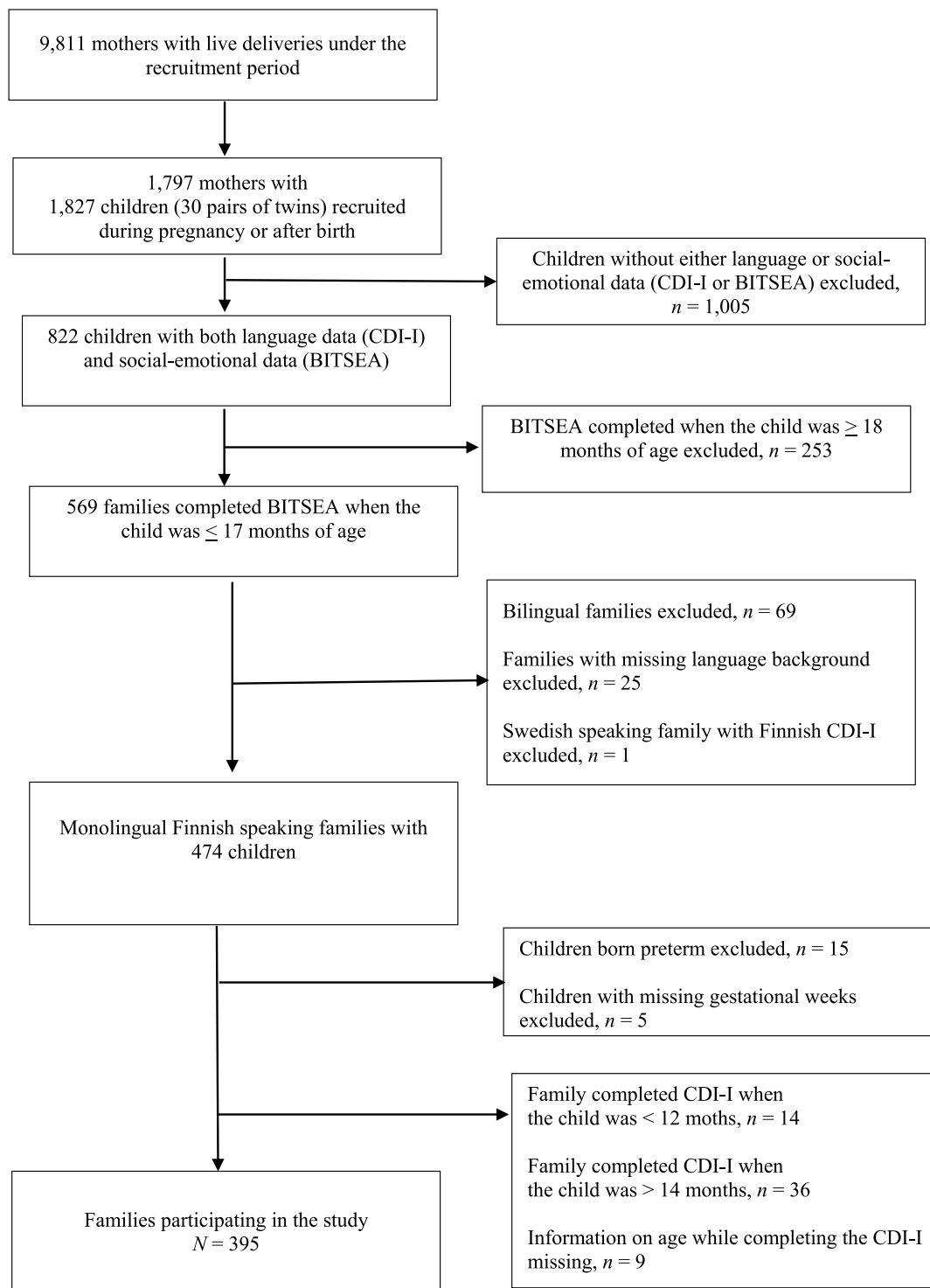


Fig. 1. Flowchart showing final sample selection.

1. Do preverbal and early verbal skills in infancy have associations with subsequent social-emotional competencies in early toddlerhood?

We hypothesized that lower preverbal and early verbal skills in infancy would be associated with subsequent delays in social-emotional competencies, motivated by Horwitz et al., (2003) who reported that poor expressive language was linked to social-emotional competencies in very young children.

2. Do preverbal and early verbal skills in infancy have associations with subsequent social-emotional and behavioral problems in early toddlerhood?

We hypothesized that lower preverbal and early verbal skills in infancy would be associated with subsequent social-emotional and behavioral problems in early toddlerhood, motivated by St Clair et al., (2019) who found that early language difficulties have negative effects on the development of social interaction and emotional self-regulation abilities.

3. Do sociodemographic factors, often found to influence language development in children, moderate these associations?

We hypothesized that the association between preverbal and early verbal skills and subsequent social-emotional and behavioral problems would be stronger for boys than girls because boys tend to have a higher risk for language disorders Rudolph (2017), and a slightly slower rate of verbal development than girls (Fenson et al., 1994; Stolt et al., 2008).

## 2. Material and methods

The present study is a sub-study of the Finnish cohort study Steps to the Healthy Development and Well-being of Children (the STEPS Study), a longitudinal, population-based multidisciplinary study of children born to mothers in an area of Southwest Finland over the course of two years, from the first of March 2008 to the end of March 2010 (for more detail see Lagström et al., 2013). Consequently, the cohort population was comprised of 9811 mothers with their 9936 children. A subset of these mothers was recruited to participate in an intensive follow-up either during the first trimester of pregnancy, when they were visiting the maternity clinic, or after delivery at the hospital. Altogether 1797 Finnish- and Swedish-speaking mothers with 1827 children accepted the invitation.

The STEPS Study was approved by the Ministry of Social Affairs and Health and the Ethics Committee of the Hospital District of Southwest Finland (27 February 2007). A written informed consent was obtained from the parents.

### 2.1. Participants and the recruiting process

The sample for the present study was taken from the intensive follow-up group of 1797 mothers with 1827 children and included only monolingual Finnish-speaking families who had completed both the MacArthur Communicative Development Inventory for Infants (CDI-I; Fenson et al., 1994) and the Brief Infant–Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006). The parents were instructed to complete the CDI-I form when the child was 13 months of age, but they did so anywhere from age 11 to 16.2 months. To avoid a large age variation in communication and language assessments, only children aged  $13 \pm 1$  month were included, giving a mean age of 13.2 months. They are called infants hereafter.

Parents were instructed to complete the BITSEA form when the child was 18 months old, but they did so at different ages varying

**Table 1**

Comparison of the characteristics of excluded and included study participants based on the chi-square test and % for categorical variables and t-test and mean (SD) for numerical variables.

	Variables	Excluded participants <sup>a</sup>	Included participants <sup>b</sup>	<i>p</i>
Child	<i>Outcome variables</i>			
	BITSEA Problem total, mean (SD)	8.09(4.47)	8.31(5.03)	.572
	BITSEA Competence total, mean (SD)	17.58(2.92)	17.36(2.56)	.306
	BITSEA Cut Problem, %	17.2	16.8	.885
	BITSEA Cut Competence, %	3.1	3.8	.643
	<i>Sociodemographics</i>	( <i>n</i> =1417)	( <i>n</i> =395)	
	Sex: boy, %	52.2	51.6	.864
	Apgar score (5 min), mean (SD)	8.97(0.95)	9.04(0.86)	.195
	Age in years, mean (SD)	30.73(4.70)	30.91(4.26)	.448
	Marital status married, %	56.9	62.1	.064
Mother	First child of the mother, %	52.9	61.0	.005
	Received special education, %	16.3	18.7	.288
	Social status, Occupational class at least professional, % <sup>c</sup>	60.6	61.7	.707
	Vocational education at least tertiary degree, % <sup>d</sup>	58.3	66.7	.003
	Family income at least 3000€/month, %	45.4	46.4	.772

BITSEA = Brief Infant–Toddler Social and Emotional Assessment

CDI-I = MacArthur Communicative Development Inventory, Infant form

<sup>a</sup> (*n* = 256–257); including only children under 18 months

<sup>b</sup> (*n* = 394–395)

<sup>c</sup> Classification: Professionals (in high positions, e.g. managerial, but also in intermediate positions, such as nurses) vs others [blue-collar workers (in industry or agriculture) and service (e.g. clerical and sales workers)]

<sup>d</sup> Classification: Tertiary degree (high educational degree, e.g. university degree, but also polytechnic degree) vs others (school or community level and persons without vocational education)



from 10 to 42 months. Following the age definition applied for the communication and language development assessment (CDI-I), only BITSEA data from children aged 17 months or younger were included. This age group has different BITSEA cut-off thresholds than older children for defining possible problems from the total scores. Thus, the social-emotional assessment was conducted slightly later than the communication assessment. This group included children aged 14 to 17 months with a mean age of 16.9 months. They are called early toddlers hereafter.

In the present study, 69 families were bilingual, 25 did not produce information on the family's language background, and one Swedish-speaking family had completed the Finnish CDI-I form. These 95 families were excluded from the study. The flowchart in Fig. 1 shows the recruitment and selection process of the study sample. Fifteen children were excluded due to prematurity (< 37 weeks) and five due to missing gestational weeks, resulting in a final sample of 395 monolingual Finnish-speaking families.

Of the 395 children in the sample, 204 were boys (51.6%) and 191 girls (48.4%). Over half of them had no siblings (58.2%), about one fourth had one sibling (26.8%), one tenth had two siblings (10.1%), and the rest had three to eight siblings (4.9%). The mean age of the mothers when giving birth was 30.91 years ( $SD = 4.26$ , range 20–43 years) and of the fathers 33 years ( $SD = 5.2$ , range 20–56 years). The age of the father was not given in 18 cases. The mean gestational age was 40 weeks, ranging from 37 to 42.7 weeks ( $SD 8.6$ ). The mean Apgar score at 5 min was 9.04, ranging from 5 to 10 ( $SD = 0.86$ ).

The marital status of the families was married in 62.1% of cases, cohabiting in 35.8%, and other in 2.1%. This information was missing for four participants. The social status of mothers and fathers was defined by occupation and categorized as high, meaning professional, or low, meaning non-professional (see footnote under Table 1). Of the mothers, 61.7% belonged to the high category and 38.3% to the low, and the information was missing for 50 mothers. Of the fathers, 54.9% belonged to the high category and 45.1% to the low, and the information was missing for 80 fathers. The net family income per month during pregnancy was over EUR 3000 for 46.4% of the families and less than that for 53.6%. For nine families this information was missing. The average net family income per month during the data collection period was EUR 3120 (2008) and EUR 3173 (2009) (Statistics Finland's PX-Web databases), which can be classified as middle income for a household in Finland.

To obtain information on possible heredity of language and learning difficulties, the parents were asked whether they had received any special education during their school years, to which 18.7% of the mothers and 27.6% of the fathers answered yes. However, the reason for receiving special education was not given in the questionnaire.

## 2.2. Data attrition

The present study experienced high rates of attrition owing to both study dropout and the exclusion criteria outlined in Fig. 1. To inspect possible attrition bias, we examined whether the study participants differed systematically from the group consisting of both dropouts and excluded participants (non-participants hereafter) in terms of background characteristics and outcome variables. From previous studies with this cohort we know that participating families in the STEPS Study differ from the whole cohort population with regard to family background. Compared to non-participants, participating mothers were, on average, 7 months older than in the whole cohort population and more likely to be parenting a first-born child, married, living in an urban area, and of a somewhat higher occupational status (see Lagström et al., 2013). Following the intensive study group further, no differences between dropouts and non-dropouts were reported at the 13-month data collection point (Lagström et al., 2013).

Families included in the analyses of the present study differed from non-participants with regard to family background (Table 1). Participating mothers were more likely to have at least a tertiary degree in education (66.7% vs 58.3%) and their child was more likely their first (61.0% vs 52.9%). No differences between non-participants and participants were found regarding study outcomes.

## 2.3. Measurements

The data were gathered from parents by questionnaires in electronic or paper format, with a prepaid return envelope for the latter.

### 2.3.1. Questionnaires on demographic information

Mothers completed questionnaires about family-related details and demographic factors during the 10th–15th weeks of gestation and both parents separately at the 20th and 30th week of gestation. Mothers recruited at the delivery ward completed the questionnaires at the time of delivery. Structured demographic information together with family- and child-related information was also gathered from one or both parent(s) when the child was 13, 18 and 24 months of age. The questionnaires were largely in multiple-choice format.

### 2.3.2. Communication and language development measure

The Infant form of MacArthur Communicative Development Inventory, Word and Gestures (CDI-I; Fenson et al., 1994, 2007) was used to measure preverbal gestural communication and early receptive and expressive vocabulary in children. Only the Finnish version was used (Lyytinen, 1999, with normative data). CDI-I is a checklist of different communicative behaviors and words. It consists of two parts: Part I Early words and Part II Actions and gestures. Part I consists of subscales on the *First signs of understanding*, *Understanding directions and questions*, *Starting to talk*, and *Vocabulary*. Each subscale in Part I gets its own sum score, but subscale *Vocabulary* has two sum scores, one for *Receptive vocabulary* and one for *Expressive vocabulary*.

From Part I all but one of the five subscales were used as independent variables in the analysis. Subscale *Starting to talk* was omitted because it has only two questions and subscale *Vocabulary* describes children's receptive and expressive vocabulary better with a list of 380 words.

Part II Actions and gestures consists of six subscales: *First communicative gestures*, *Games and routines*, *Actions with objects*, *Pretending to be a parent*, *Imitation of adult actions*, and *Pretend objects*. Each subscale gets a sum score and is then combined as a total sum score called *Total actions and gestures*.

Because of extremely non-normal distributions on the following CDI-I scales: 1) *First signs of understanding*, 2) *Expressive vocabulary*, and 3) *Receptive vocabulary*, scores were converted to dichotomous variables to attain greater statistical power. Scores in *First signs of understanding* were categorized as *yes* if the score was between 1 and 3 (max 3) and *no* if the score was 0. *Expressive vocabulary* was dichotomized according to the median, which was 3 words, and *Receptive vocabulary* was dichotomized according to the median, which was 90 words. The rest of the communication variables, *Understanding directions and questions*, *First communicative gestures* and *Total actions and gestures* had normal distribution and were included as continuous variables.

Before the analysis, some decisions were made concerning the use of different scales of CDI-I. Subscale *Pretend objects* was omitted from the *Total actions and gestures* score due to earlier findings that because there is only one question, there is little variation and it does not function properly psychometrically (Fenson et al., 1994). In addition, subscale *First communicative gestures* was analyzed separately, as we were interested in the first signs of intentional and target-oriented communication in children who do not yet produce words or have only a few expressive words.

### 2.3.3. Social-emotional competencies and problems measure

In this study we administered the Finnish translation of the Brief Infant–Toddler Social and Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006). The Finnish version was used for the first time as a pilot study by Haapsamo et al. (2009) and refined by Alakortes et al. (2017). BITSEA is a parent-report screening tool for identifying possible SEB problems, and/or delays and deficits in the acquisition of social-emotional competencies in children aged 12 months to 35 months and 30 days (Briggs-Gowan & Carter, 2006). It has been shown to be a valid method for screening SEB problems and delays or deficits in social-emotional competencies (Bagner et al., 2012; Briggs-Gowan et al., 2001; Haapsamo et al., 2009; Pontoppidan et al., 2017). It includes 42 items, of which 31 address problems in internalizing, externalizing, and regulatory domains, as well as rare behaviors that may be indicative of autism spectrum disorders or other psychopathology (examples of items: Hits, shoves, or bites children (not including brother or sister), Seem very unhappy, sad, depressed, or withdrawn, and Does not make eye contact), and 11 items addressing delays and deficits in the acquisition of social-emotional competencies (Follows rules, Points to show you something far away, Hugs or feeds dolls or stuffed animals). Responses to the items are rated 0 for Not True or Rarely, 1 for Somewhat True or Sometimes, and 2 for Very True or Often. Two items include additional alternative N for No Opportunity. The BITSEA assessment gives total scores both for competencies (max 22) and problems (max 62). To be able to define possible delay in competencies and possible SEB problems, both scores have certain clinical cut-off points depending on the sex and age of the children (Table 2). Total problem scores above the cut-off value indicate possible SEB problems, and Total competence scores below the cut-off value indicate delays or deficits in social-emotional competencies. Cut-off scores were used in the present study in the same way as in the study of Alakortes et al. (2017).

### 2.4. Statistical analysis

Statistical analyses were executed with SAS for Windows Release 9.4 and IBM SPSS Statistics Version 26. *p*-values < 0.05 were considered statistically significant. The dependent variables were *delays in social-emotional competencies* and *potential SEB problems*, defined with cut-off procedure in BITSEA, and the independent, explanatory variables were the preverbal gestural and early verbal communication skills in CDI-I. The distribution and amount of variation in the total scores of the different variables are described with mean, median, standard deviation and range (Table 3). Binary logistic regression analyses were conducted to explore the associations between preverbal and verbal communication skills in infancy and possible SEB problems and delays in social-emotional competencies in early toddlerhood.

In the unadjusted binary logistic regression analysis the two outcome variables *SEB problems* and *delays in Social-emotional competencies*, were analyzed with all of the communication skill variables one by one (*First signs of understanding*, *Receptive vocabulary*, *Expressive vocabulary*, *Understanding directions and questions*, *First communicative gestures* and *Total actions and gestures*).

Analyses with dichotomous communication variables (*First signs of understanding*, *Receptive vocabulary* and *Expressive vocabulary*) were conducted separately for the group identified with SEB problems and for the group identified with delays in social-emotional competencies. In the analyses with continuous communication variables (*Understanding directions and questions*, *First communicative gestures* and *Total actions and gestures*) the whole sample was included and comparisons were examined between children with versus

**Table 2**

BITSEA cut-off points for Problem total and Competence total scores to indicate possible social-emotional and behavioral problems or delay in social-emotional competencies.

		12–17 Mos.	18–23 Mos.	24–29 Mos.	30–35 Mos.
Possible SEB problem	Girls	13	13	14	12
	Boys	13	15	15	14
Possible deficiency/delay in social-emotional competencies	Girls	12	14	15	16
	Boys	12	14	14	14

Briggs-Gowan and Carter, 2006, p. 10.



**Table 3**

Descriptive statistics for communication subscales (CDI-I) at age 13 months and social-emotional and behavioral subscales (BITSEA) at age 17 months as a total group and separately for boys and girls.

	All (N=395) Mean (SD) Median Range	Boys (n=204) Mean (SD) Median Range	Girls (n=191) Mean (SD) Median Range	Difference between boys and girls <i>p</i>
CDI-I Communication subscales (min-max)				
First signs of understanding (0–3)	2.91 (0.30) 3	2.90 (0.30) 3	2.92 (0.30) 3	.299 <sup>c</sup>
Understanding directions and questions (0–27)	15.03 (5.99) 15	14.37 (5.8) 14	15.73 (6.2) 15	.024 <sup>d</sup>
First communicative gestures (0–20) <sup>a</sup>	11.27 (2.57) 11	10.82 (2.44) 11	11.75 (2.63) 12	< .001 <sup>d</sup>
Total actions and gestures (0–66) <sup>a</sup>	31.79 (8.15) 32	30.14 (7.56) 30	33.55 (8.41) 34	< .001 <sup>d</sup>
Receptive vocabulary (0–380)	105.91 (67.27) 90	99.05 (62.5) 85	113.24 (71.4) 97	.066 <sup>c</sup>
Expressive vocabulary (0–380)	7.00 (11.28) 3	5.42 (7.2) 3	8.68 (14.3) 4	.023 <sup>c</sup>
	0–105	0–42	0–105	
BITSEA Subscales (min-max)				
Competence total (0–22, cut-off < 12)	17.36 (2.56) 18	16.91 (2.59) 17	17.84 (2.45) 18	< .001 <sup>d</sup>
Problem total (0–62, cut-off > 13) <sup>b</sup>	8.31 (5.03) 8	8.24 (4.95) 8	8.39 (5.12) 8	.774 <sup>d</sup>
	0–34	0–33	0–34	

<sup>a</sup> boys *n* = 201, girls *n* = 189

<sup>b</sup> boys *n* = 203

<sup>c</sup> Mann-Whitney U test, <sup>d</sup> *t*-test

without SEB problems and between children with versus without delays in social-emotional competencies.

Effects of the background variables on the outcome variables were analyzed with Fisher's Exact test. These variables were sex of the child, Apgar score 5 min after birth, mother's age when giving birth, mother's social status, father's social status, special education of the mother, and special education of the father. Statistically significant background variables were added into the adjusted binary logistic regression analysis as covariates with those dependent variables which had significant unadjusted effects.

In addition, the interaction between an early language composite and social-emotional competencies in predicting SEB problems was analyzed.

### 3. Results

#### 3.1. Descriptive statistics

Descriptive statistics for the ratings of preverbal gestural communication and early verbal skills (CDI-I) and social-emotional competencies and SEB problems as total scores (BITSEA) are presented in Table 3. There was considerable variation in the scores for all but one scale of the communication variables. Subscale *First signs of understanding* had only three questions and most of the participants had reached the ceiling. Girls had somewhat higher scores in all of the other communication scales except *First signs of understanding*. Girls also tended to have higher *Competence total* scores than boys in BITSEA.

After the cut-off procedure, fifteen children (3.8%) were identified as having scores below the clinical cut-off in Competence total, indicating delays in social-emotional competencies. There were more boys in this group than girls  $\chi^2(1, N = 395) = 7.658, p = 0.006$ . Sixty-six children (16.7%) scored above the clinical cut-off in the Problem total score, indicating SEB problems. There was no statistically significant difference in number of boys and girls in this group.

#### 3.2. Associations between communication skills and social-emotional competencies and SEB problems

Fifteen toddlers in the sample were identified with delays in social-emotional competencies and 66 with SEB problems. The risk for delays in social-emotional competencies and SEB problems, depending on the communication skills in infancy, were analyzed first with the dichotomized communication variables describing children with lower and higher scores in these variables, and then with the continuous variables.

Binary logistic regression analysis revealed a possible risk between lower communication skills and delays in social-emotional competencies. The full logistic regression results are reported in Table 4. Children who had fewer than 89 words in their receptive vocabulary as infants had 6.9 times significantly higher risk of delays in social-emotional competencies in early toddlerhood than children with higher scores. Children with fewer than three words in their expressive vocabulary had 4.0 times significantly higher risk of delays in social-emotional competencies than children with three or more words.

Children with no signs of understanding speech, receptive vocabulary under 89 words, and expressive vocabulary of less than three words in infancy were not at significantly elevated risk of SEB problems in toddlerhood than children with higher scores in these communication abilities (see Table 4).

When the continuous communication variables (*Understanding directions and questions*, *First communicative gestures* and *Total actions and gestures*) were used as explanatory variables in the binary logistic regression analyses, separate analysis were done for SEB problems and delays in social-emotional competencies. In both analyses the whole sample was included but divided into two groups based on the presence of elevated SEB problems, and two groups based on delays in social-emotional competencies. The bottom half of Table 4 presents this logistic regression analysis.

The analyses showed that children with lower scores in *Understanding directions and questions* had 2.2 times significantly higher risk of delays in social-emotional competencies than children with higher scores in this communication variable. Children with few communicative gestures had 2.8 times significantly higher risk of delays in social-emotional competencies, and children with lower scores in total actions and gestures had 2.4 times significantly higher risk of delays in social-emotional competencies than children with higher scores in these communication abilities (Table 4).

Children with lower scores in understanding directions and questions, few communicative gestures, and few total actions and gestures in infancy did not have higher risk of SEB problems in early toddlerhood than children with higher scores in these communication variables.

The unadjusted analysis showed statistically significant associations between communication skills in infancy and social-emotional competencies in toddlerhood, but not between communication skills and SEB problems. Fisher's exact test revealed that the child's sex and if the mother had received special education at school age had significant effects on the child's social-emotional competencies ( $p = 0.007$  and  $p = 0.002$ , respectively). The next stage in the analysis was the adjusted binary logistic regression with these significant

**Table 4**

Effect of communication skills (CDI-I) at age 13 months on SEB problems and delays in social-emotional competencies at age 17 months (BITSEA). Binary logistic regression analysis: Odds Ratio (OR) counted per 1 standard deviation for continuous factors. Each significant effect in the Unadjusted Analysis was verified in an Adjusted analysis that considered sociodemographic variables (i.e., sex and mother's special education at school).

CDI-I	UNADJUSTED			ADJUSTED			
	SEB problems			Delays in SE competencies		Delays in SE competencies	
	<i>n</i> (%)	<i>OR</i> (95% CI)		<i>n</i> (%)	<i>OR</i> (95%CI)		<i>OR</i> (95%CI)
First signs of understanding <sup>1</sup>							
no	8(24)	1.7(0.7, 3.9)		2(6)	1.7(0.4, 8.0)		
yes	58(16)	1		13(4)	1		
Receptive vocabulary <sup>1</sup> ( <i>Mdn</i> )							
< 89 words	35(18)	1.2(0.7, 2.0)		13(7)	6.9(1.5, 31.1)*		5.9(1.3, 27.2)*
≥ 90 words	31(16)	1		2(1)	1		1
Expressive vocabulary <sup>1</sup> ( <i>Mdn</i> )							
< 3 words	40(20)	1.6(0.9, 2.7)		12(6)	4.0(1.1, 14.3)*		3.3(0.9, 12.2)
≥ 3 words	26(14)	1		3(2)	1		1
	<u>no</u> <sup>3</sup> <i>mean</i> ( <i>sd</i> )	<u>yes</u> <sup>4</sup> <i>mean</i> ( <i>sd</i> )	<i>OR</i> (95% Ci) <sup>p</sup>	<u>no</u> <sup>5</sup> <i>mean</i> ( <i>sd</i> )	<u>yes</u> <sup>6</sup> <i>mean</i> ( <i>sd</i> )	<i>OR</i> (95% Ci) <sup>p</sup>	<i>OR</i> (95% Ci) <sup>p</sup>
Understanding directions and questions <sup>2</sup>	15.1 (6.0)	14.9(6.2)	1.0(0.8, 1.3)	15.2 (6.0)	10.8(5.1)	2.2(1.2, 3.9)**	2.1(1.2, 3.9)*
First communicative gestures <sup>2</sup>	11.2 (2.5)	11.5(2.9)	0.9(0.6, 1.2)	11.4 (2.5)	8.9(2.5)	2.8(1.6, 5.0) ***	2.4(1.3, 4.4) **
Total actions and gestures <sup>2</sup>	31.6 (8.0)	32.5(8.9)	0.9(0.7, 1.2)	32.1 (8.1)	25.1(6.2)	2.4(1.4, 4.3)**	2.7(1.4, 5.1) **

Note. OR = Odds Ratio

<sup>1</sup> = dichotomous factor

<sup>2</sup> = continuous factor

<sup>3</sup> n=324–328

<sup>4</sup> n=65–66

<sup>5</sup> n=375–380

<sup>6</sup> n=15, SE = Social-emotional competencies, \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

background variables included with social-emotional competencies and separately with every communication variable. Adjusted analyses with possible SEB problems were not conducted because of lack of significant effects in the unadjusted analyses. In addition, analysis with *First signs of understanding* was left out because of the lack of significant effect in unadjusted analysis. Adding sex and mother's special education variables into the adjusted analysis did not change the pattern of the findings, except that children with low scores in their expressive vocabulary no longer showed a significant risk of delays in social-emotional competencies. All the other associations reported in the unadjusted analysis remained the same with regard to odds ratios, confidence intervals and statistical significance (see Table 4).

To study the interaction effects between the early language composite and social-emotional competencies in predicting SEB problems, the relations were tested first pairwise. None of the explanatory variables was statistically significant but social-emotional competencies approached significance ( $p = 0.053$ ). When the interactions were tested no significant interaction effects were found.

#### 4. Discussion

The aim of the present study was to examine whether there are any associations between preverbal and early verbal communication skills in infancy and subsequent social-emotional competencies and social-emotional and behavioral (SEB) problems. The possible effects of contextual factors on these associations was also studied. It was hypothesized that low preverbal and early verbal communication skills in infancy would relate to subsequent delays in social-emotional competencies, as well as to SEB problems. It was also hypothesized that the sex had an effect on these associations. The main result was that low skills in preverbal and early verbal communication in infancy are associated with delays in social-emotional competencies in early toddlerhood, but not with SEB problems.

##### 4.1. Predictive validity of preverbal gestural communication and early verbal skills for social-emotional competencies

Low preverbal and early verbal communication skills in infancy predicted subsequent delays in social-emotional competencies in early toddlerhood, which supports part of our hypothesis. Children with low skills in gesture communication, as well as in play and imitation of actions in infancy, had higher risk of delays in social-emotional competencies in early toddlerhood than children with higher skills in this type of preverbal communication. The finding that low gestural communication skills in infancy predicted delays in social-emotional competencies in toddlerhood is new but resembles the findings of Irwin et al. (2002) and Horwitz et al. (2003) with slightly older children. They found that late talkers at about 2 years of age had concurrent deficits in imitation and pretend play more often than control children according to maternal reports in the Infant-Toddler Social and Emotional Assessment (ITSEA). It seems that CDI-I and ITSEA measure partly the same skills, but CDI-I from the viewpoint of communication and ITSEA from the social-emotional aspect. Pragmatic development in infancy begins with eye contact, proceeds to joint attention, and advances to communication with pointing and gestures, which are used like words in interactions (Brooks & Meltzoff, 2005; Colonesi et al., 2010; Goldin-Meadow, 2009; Orr, 2018). It is possible that a delay in pragmatic development in infancy manifests first as low skills in preverbal communication and later as a delay in social-emotional competencies because of the social-pragmatic nature of language and communication development Bruner (1983). It is also possible that in some children slow preverbal communication development co-occurs with delays in social-emotional competencies. Pretend play, as a social event, and early gestural communication emerge at the same time after the first birthday and a delay in the child's development possibly manifests in both of them. It is also possible that a delay in pragmatic development in infancy causes a concurrent delay in the development of social-emotional competencies. For example children with high risk for ASD use less gestures than children with typical development (Ramos-Cabo et al., 2019). Pragmatic development, the ground for communicative development, occurs in dyads in social interaction (Stephens & Matthews, 2014). The child begins to respond to the caregiver's eye contact, speech and emotional attunement, and begins to imitate and take his/her own turns in these first "conversations" Airenti (2017). If this pragmatic development is delayed, it can affect also the development of social-emotional competencies. It is important to support the development of pragmatic communication skills in infants, which in turn supports language development and the development of their social-emotional competencies (Gulrud et al., 2014).

In addition to low preverbal skills, low skills in receptive and expressive vocabularies and understanding directions and questions in infancy also predicted delays in social-emotional competencies in early toddlerhood. Children with lower skills in comprehension and expressive language in infancy had higher risk of delays in social-emotional competencies in toddlerhood than children with better language skills. This supports Longobardi et al. finding (2016) that level of language skills, more than the age of the child, is related to social-emotional development. Language skills in typically developing preschoolers also have been found to play a significant role in social competence (Haapsamo et al., 2012; Longobardi et al., 2016). Rescorla et al. (2007) found an association between delayed language development and social withdrawal in toddlers, a symptom that reflects deficits in social-emotional competencies (Briggs-Gowan & Carter, 2006).

Early receptive language skills predicted social-emotional competencies in toddlerhood in the present study. The language measure in similar studies has most often been only expressive vocabulary (Henrichs et al., 2013; Horwitz et al., 2003), but Irwin et al. (2002) and Thurm et al. (2018) included separate measures for expressive and receptive vocabulary in their study and found that both of them related to social-emotional competencies and problems. Although participating children in their study were slightly older than in the present study, the results of our study support their findings. Slow development of preverbal communication with gestures and actions and a delay in receptive language skills might reflect normal variation, but they can also cause or be intertwined with a delay in the development of social-emotional competencies, which can be a risk factor for SEB problems later in toddlerhood.

#### 4.2. Predictive validity of preverbal gestural communication and early verbal skills for social-emotional and behavioral problems

No significant associations between low preverbal gestural and early verbal communication skills and SEB problems were found, meaning that this part of the hypothesis was not supported. Children with low communication skills in infancy were not at higher risk of SEB problems in early toddlerhood than children with better communication skills. This was true both for preverbal gestural communication skills and for receptive and expressive vocabulary. This finding is in contrast to earlier research showing that there are associations between difficulties in language development and SEB problems in toddlers (Henrichs et al., 2013; Horwitz et al., 2003; Irwin et al., 2002; Keegstra, et al., 2010; Sim et al., 2013; Whitehouse, et al., 2011). The reason for different results may be that children in the present study were younger than those in previous studies, and that behavior problems are not commonly apparent until after the first birthday (Möricke et al., 2013), despite the fact that some problem behaviors have been detected in 10-month-old children (Skovgaard et al., 2008). For example, social communication skills in children with ASD do not differ significantly from children with typical development during the first year of life, but begin to differ after 12 months (Iverson et al., 2018).

Another reason for the discrepancy in the results can be that in the previous studies the participants have been children already identified as delayed in their language development but participants in the present study were a group of children in a cohort and low communication skills in some of the children could reflect typical, individual variability. In addition, only one of the previous studies has assessed communication skills and SEB problems as early as in the present study (Horwitz et al., 2003), and none have used preverbal skills in the communication assessment. The language measure has most often been expressive vocabulary. Thus, the reason for the different results can be that the participants in most of those studies have been slightly older and had already reached the stage of word production in their language development. It is possible that existing associations between SEB problems and low level of communication skills can not be seen until the child has developed further, and the deficiency in verbal communication development can be detected. There is support for this in the study by Horwitz and colleagues (2003) on associations between delayed expressive language development and social-emotional competencies and SEB problems in four different age groups, varying from 12 to 39 months. Delays in social-emotional competencies were found already in younger children, but not SEB problems related to language delay until the oldest group was at least 36 months of age.

#### 4.3. Effect of background factors

There were significantly more boys than girls who had delays in social-emotional competencies, but the same difference was not present in SEB problems. This gave some support to the hypothesis that sex has an effect on these associations. The reasons for this finding may be a slower rate of the communication and language development in boys at this age, which has an influence on social-emotional competencies, if they are developing concurrently. However, the association disappeared when the analyses were adjusted for background factors.

The following background factors were controlled: child sex, Apgar score 5 min after birth, mother's age when giving birth, mother's social status, father's social status, special education of the mother, and special education of the father. Only two of them, child sex and mother's special education during school age were significant. These two variables were added into the adjusted analysis with the variable of delayed social-emotional competencies. The predictive validity of low skills in communication variables on delays in social-emotional competencies remained the same as in the unadjusted analysis except that association with expressive vocabulary disappeared. The reasons for this finding may be that the expressive vocabularies were very small at this age, and boys had smaller expressive vocabularies than girls. The difference of language development in boys and girls has been revealed in many studies (Fenson et al., 1994; Fenson et al., 2007; Stolt et al., 2008), and boys also have higher risk of developmental language disorder than girls (Flax et al., 2003; Zambrana et al., 2014).

The effect of the mother having received special education at school age was not hypothesized, but it is possible that mothers with this type of educational background talk less with their children and give less verbal input than mothers without it. This has been found, for example, with mothers with dyslexia (Lyytinen et al., 2003). What is interesting is that special education of the father at school age had no effect, even though more fathers had received special education than mothers. The child's sex and mother's special education did not affect the associations between other measured communication skills and delays in social-emotional competencies, only expressive vocabulary.

Receptive vocabulary, understanding directions and questions, first communicative gestures, and total actions and gestures did maintain their predictive validity even after controlling for the following background factors: child sex, and special education of the mother. These communication skills belong to an earlier stage of language development than production of words. Based on these results of the present study, the use of gestures and actions, as well as comprehension of language, appear to be more feasible measures than expressive language to examine associations between communication skills and social-emotional development in infants.

#### 4.4. Limitations and future research

There are some limitations to this study which should be considered when interpreting the results. Compared to the number of participants in the intensive follow-up group, the sample was quite small due to the prerequisite that the families had to have completed both the CDI-I and BITSEA questionnaires by a certain age of the child. This criterion was set to ensure that consecutive assessments of CDI-I and BITSEA could be made within a reasonable interval. In addition, there were fewer children with delays in social-emotional competencies in the present study than in previous studies conducted in Finland and internationally (Briggs-Gowan et al., 2001; Haapsamo et al., 2009). This could be due to the children being younger than in previous studies when BITSEA was

completed.

Only 15 children had delays in social-emotional competencies. When they were divided into groups based on their results in the communication variables, some groups only had two or three participants, which may have affected the power of the analysis. However, despite the small sample size the results of binary logistic regression analysis could show statistically significant effects.

Neurodevelopmental disorders can affect language and social-emotional development. The present study could have included some children with these disorders, but this was not controlled for. This should be taken into account in future research. There are also other possible factors influencing the studied factors. Because social interaction with adults is crucial for communication and language development in infants, as well as for social development, it would be important in future research to observe the style and degree of interaction between the child and the main adult taking care of him or her.

#### 4.5. Conclusions

Our findings support close associations between preverbal communication skills and early receptive language skills and social-emotional competencies in the early years. Late development of receptive language in infancy, as well as scarce preverbal communication with gestures and pretend play, can be a sign of possible concurrent or developing delays in social-emotional competencies, which become visible in later toddlerhood. These can later progress to SEB problems. Thus, early communication skills are important to monitor in order to guide care givers in supporting early pragmatic communication and language development already in infancy if needed.

#### Credit authorship contribution statement

Pirkko Rautakoski: Conceptualization, methodology, data collection, writing of the original draft, and funding acquisition. Piia af Ursin: Statistical analysis and writing. Alice S. Carter: Methodology and writing. Anne Kaljonen: Statistical analysis. Annette Nylund: Writing. Päivi Pihlaja: Methodology, data collection, writing, and funding acquisition.

#### Declaration of Competing Interest

The authors declare that there is no conflict of interest.

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